NORTHERN CALIFORNIA BOTANISTS

BOTANICAL LEAFLETS

ISSUE 29 FALL 2022

PRESIDENT'S MESSAGE

We've had our first winter storms of the season, which hopefully will mean we will have a winter that is wetter than the last several years. We could sure use it!

Hopefully everyone has been able to do their best with the pandemic still here and still having wildfires. My extended family lost our cabin in the Dixie Fire in August 2021. We are now developing the plans to rebuild which has taken time and has been a lot of work.

We plan to have our next symposium in January 2024. We will keep you informed as we develop this upcoming symposium.

Len Lindstrand III has joined our board. Len is the Botany Program Manager for Sierra Pacific Industries. Welcome Len!

We have received applications for the Dean W. Taylor Botanical Exploration Memorial Award to honor Dean Taylor's goals of finding unknown botanical diversity in northern California. The awardees will be announced this winter.

Take care and stay healthy during this pandemic.

Linnea Hanson
President

WELCOME LEN LINDSTRAND III TO THE NCB BOARD!

Northern California Botanists is pleased to announce the appointment of Len Lindstrand III to the Board. Len serves as the Botany Program Manager for Sierra Pacific Industries (SPI) in Anderson, California. At SPI he leads a talented botany staff that covers nearly 1.9 million acres of timberlands throughout California's North Coast, Klamath and Cascade Ranges, Modoc Plateau, and Sierra Nevada. Read more about Len on the BOTANISTS IN ACTION page in this NEWSLETTER. Welcome Len!

MYSTERY PLANT

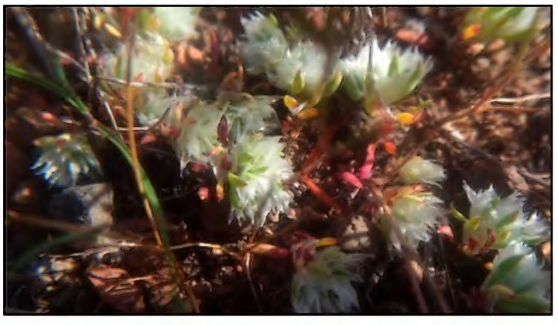


Photo: April 8, 2021 approximately 5 miles north of Dales in Tehama County.

Answer on Page 2

This is a true belly plant, the stem is not much more than 1 cm tall and is hidden by leaves and flower clusters. It is so diminutive that it was not formerly described in 1985 by Barbara Ertter. This small annual herb flowers in the spring and grows on volcanic uplands, in rocky outcrops and along margins of vernal pools. The bristle-tipped green leaves are only a few millimeters in length with oval-shaped stipules. A single flower occurs in each leaf axil and has no petals but white, rough-textured, awn-tipped sepals clustered around the leaves.

INSIDE THIS ISSUE:

TRIBUTE TO BARBARA CASTRO

It is with great sadness, that we inform you of the passing of Barbara Castro. Barb passed away on December 4, 2022 after a long bout with cancer. Barb was a founding board member of Northern California Botanists, a passionate botanist, a good friend, and overall special person.

By the time Barb moved to Chico around 1980, she already had a B.A. in Biology from Harvard, a M.S. in Environmental Planning from Stanford, and had worked for several years as an Environmental Analyst in a small consulting firm in the then brand-new field of environmental impact analysis. Once in Chico, she continued working for that consulting firm and eventually enrolled at Chico State in 1985, earning her M.S. in Botany several years later.

While working seasonally for the Forest Service, Barb also worked as a consulting botanist. In 1992, while conducting surveys for a project in central Butte County, she rediscovered a plant that was thought to be extinct, *Monardella venosa* (at the time known as *Monardella douglasii* subsp. *venosa*) (veiny monardella or windowpane monardella – Lamiaceae), a small annual California endemic that had last been seen in California in 1935 at its only other location, in Tuolumne County, and in Butte County not seen since 1883. (Seen below with her partner, Lawrence Janeway, near the discovery site congratulating each other on the discovery).

Following her work with the Forest Service, Barb went on to work for the Department of Water Resources as a Botanist / Environmental Scientist for 19 years, eventually retiring in 2019. Her work included the protection and study of rare plants, vernal pools, and other resources, and the management of invasive species. Among her other duties, Barb mentored a number of up-and-coming young botanists, developing long-lasting friendships in the process.

Barb was instrumental in getting NCB started in 2006 and was an active board member until her death. She was involved with many different tasks during her many years on the Board. She served as secretary from 2016 to 2020. Barb gave a talk at the

first symposium in 2007 on "Window on a Rare Mint: The Rediscovery of *Monardella douglasii* ssp. *venosa* (Lamiaceae)" and was involved with planning all of the NCB symposia, including chairing a session in 2010 titled "Plant-animal Interactions: Cashing In and Paying the Price" and another in 2011 titled "Pollination Biology of Common Plants in Northern California." Barb was also instrumental in developing the poster session at these symposia and chaired these sessions at every symposium. In addition, she developed the publicity for each symposium.

Besides being involved with the symposia, Barb also coordinated the research scholarship program for Northern California Botanists. Many of the members of Northern California Botanists review and rank 30 to 40 research scholarship applications each spring under Barb's leadership and attention to detail. We have been able to award 5 to 13 scholarships each year to students studying botany in Northern California since 2008. To date, we have awarded 138 of these $1,000 scholarships! In memory of Barb, the scholarship has officially been renamed the "Barbara Castro Student Botany Research Scholarship.

For her leadership, dedication, and numerous contributions to Northern California Botanists Barb was awarded a cut glass vase with *Monardella venosa* etched on it in 2016. Barb's contributions to Northern California botany have been extensive. She was a wonderful person, a great friend, and she will be dearly missed.

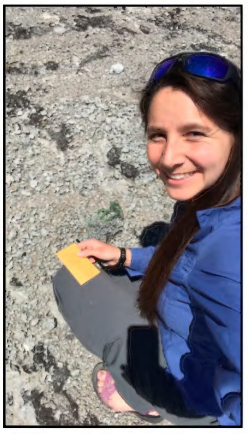
Answer to "Mystery Plant": Ahart's nailwort - *Paronychia ahartii* (Caryophyllaceae - Pink family)

NORTHERN CALIFORNIA BOTANISTS IN ACTION

Israel Borokini is a post-doctoral scholar in the University and Jepson Herbaria, Department of Integrative Biology, University of California, Berkeley. His current research focuses on assessing the spatial phylogenetics of North American seed plants with the hopes of mapping areas of unique and intact biodiversity in the United States that are yet to be protected. Additionally, he is also developing a new phylogenetic metric, trait diversity, where branch lengths are adjusted based on divergence in functional traits. Israel completed his PhD research in Ecology, Evolution and Conservation Biology at the University of Nevada, Reno. His 5-chapter dissertation evaluated the population genetic diversity and structure, and discovered several new populations of *Ivesia webberi*, a federally threatened plant species, among other research findings. His dream career is increasing scientific knowledge on the drivers of local and global biodiversity and translating this research into conservation practice.

Len Lindstrand III is a Senior Biologist with 30+ years' experience conducting a wide range of biological studies including numerous botanical investigations. After a 25-year consulting career where he developed and managed a botany and wildlife program, Len now serves as the Botany Program Manager for Sierra Pacific Industries (SPI) in Anderson, CA. At SPI he leads a talented botany staff that covers nearly 1.9 million acres of timberlands throughout California's North Coast, Klamath and Cascade Ranges, Modoc Plateau, and Sierra Nevada; where SPI Botanists typically cover 80-90 projects over 25-35,000 acres annually, while incorporating 220+ special-status plant taxa. Len also participates in SPI's management team where he collaborates with other company managers and provides program level guidance for SPI's timberland management and contributes to SPI's planning efforts by managing SPI's Anadromous Salmonid Habitat Conservation Plan and Safe Harbor Agreement. Len's experience and interests are wide ranging, but he kind-of has a thing for the rare and endemic plant taxa of the southeastern Klamath Ranges.

Pat Reynolds (shown here hiking along the Pacific Coast Trail) is the General Manager of Heritage Growers, a newly launched non-profit venture of River Partners providing source identified native seed and plugs for habitat restoration. At Heritage Growers, he works on the many steps involved in the production and use of native seeds and plants for restoration including wildland seed collection, seed amplification, and advising restoration professions on the best uses of native seed for their projects. Pat enjoys working closely with project partners and collaborators to expand the species and ecotypes that are available to improve habitat restoration outcomes. He is also on the Yolo County Planning Commission, the board of the California Native Grassland Association and is the restoration ecologist on the Yolo Habitat Conservancy's Science and Technical Advisory Committee.

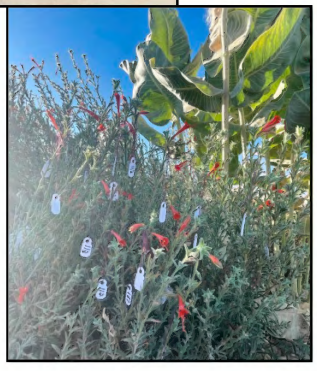


Jamey McClinton joined the Nevada Division of Natural Heritage (NDNH) in June 2022 and serves as the Supervisory Botanist. Her work includes collecting and managing data on Nevada's rare plants, helping to inform conservation and sustainable land management decisions. Jamey earned her B.S. in Ecological Management and Restoration from U.C. Davis, and her M.S. in Natural Resources and Environmental Science from the University of Nevada, Reno. She has studied rare plants and unique communities in the Great Basin for over seven years, most recently as a researcher with University of Nevada, Reno conducting a threats assessment for all critically imperiled rare plants in Nevada. She has continued her work on rare plant research since starting with NDNH. Jamey brings her passion for rare plants to her work and continues to help the agency to better understand and protect precious botanical diversity in high deserts.

2022-2023 STUDENT RESEARCH SCHOLARSHIPS

Northern California Botanists is pleased to announce the recipients of this year's research scholarship awards. As in the past, we received many worthy applications. This year we awarded 12 scholarships of $1,000 each. The Sacramento Valley and Shasta chapters of the California Native Plant Society have teamed up with NCB and are each funding one of the scholarships.

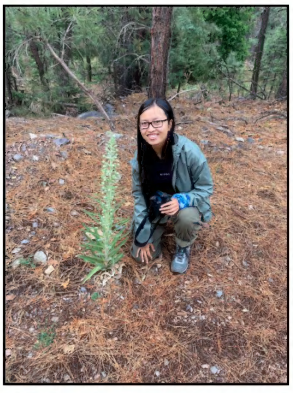
Kt Lynch is an undergrad student at the University of California, Davis.



The title of her research is **"From nectar to seeds: Do nectar bacteria increase reproductive fitness in *Epilobium canum* by becoming seed endophytes?"**

Epilobium canum (California fuchsia) is a drought tolerant native California plant that has an especially long flowering time and serves as an important late season source of nectar for many pollinators, including hummingbirds and various native bees. Its nectar hosts a unique microbial community of bacteria and yeasts that are dispersed by pollinators. Similar to interactions in soil between microorganisms and plant roots, microbes can be mutualists, commensals, or antagonists to plants. By changing the pH, sugar concentration, and chemistry of flower nectar, microbes can impact plant-pollinator interactions and pollination success of flowers. In an experiment I conducted in the fall of 2021, I found that differences in nectar bacteria have differing impacts on *E. canum* seed production, e.g. *Pantoea* increased seed set by 9%, while *Neokomagatea* had little effect. However, the mechanism behind microbial-induced differences in seed production is still unclear. In some cases, nectar microbes may become endophytic in the seed microbiome. Endophytic microbes are plant symbionts that live inside the tissues of the plant and can have important impacts on plant fitness. I plan to test whether nectar microbes change seed output through direct interaction with the seed through endophytic colonization by testing how three nectar bacteria impact seed set and viability and whether these bacteria become seed endophytes in *E. canum*. Further, I will use culture-based methods to test if nectar microbes move from nectar to seeds. If the number of viable seeds is high in fruits with endophytic bacteria from the nectar inoculum this would suggest that nectar microbes could increase plant fitness by becoming seed endophytes. The possibility of the vertical transmission of beneficial bacteria from nectar to seed and back again could improve plant fitness for generations, improving the restoration and management of native vegetative communities.

Yushin Wei is a PhD student at University of Wisconsin, Madison.
The title of her research is **"The systematics and biogeography of *Frasera* (Gentianaceae) in North America."**



Researching plant lineages in montane regions is essential for understanding how different landscapes shaped the population structures of sensitive species. *Frasera* (Gentianaceae, subtribe Swertiinae) is a genus that has the highest diversity in the Rocky Mountains and Sierra Nevada with 14 species endemics to the West and 1 widespread through eastern North America. It occurs across a wide range of elevations and hydrological regimes, exhibits interesting variation in floral form and life history strategy (monocarpic vs. polycarpic). My study focuses on the population genetics of the two widely distributed closely related species: *Frasera caroliniensis* which is native to eastern North America and *F. speciosa* which is native to western North America and has its west-most population in Northern California. While *F. caroliniensis* was strongly impacted by glaciation, climate change and landscape factors play a key role in *F. speciosa*'s evolution history. Thus, researching the population structure and historical bottleneck effect of these two species would deepen our understanding of how plants adapt to different changing environments. To date, I have collected leaf tissues from ~50 populations of *F. speciosa* (3 from Northern California) and 6 populations of *F.caroliniensis*, and am currently working on DNA extraction and GBS analysis of the populations I collected.

2022-2023 Student Research Scholarship Awards (Cont.)

Katherine Brafford is a PhD student at University of California, Davis.

The title of her research is **"Rapid evolution of native and non-native grassland species to changes in water availability."**

Climate scientists predict much of the western U.S. will be drier and experience more variable precipitation in the coming decades. Plants that survive in habitats with limited water do so by having certain combinations of functional traits (i.e. characteristics affecting performance) which allow them to either escape, avoid, or tolerate drought. In response to a changed environment, individual plants and plant populations may evolve favorable functional traits (heritable, genetic changes), pass on favorable traits from parent to offspring via epigenetics (heritable, non-genetic changes), or individually change their trait expression to suit the environment (phenotypic plasticity, non-heritable changes). The goal of our research is to discover if, and how, thirteen short-lived California grassland native and invasive species from McLaughlin Natural Reserve display adaptive changes after experiencing six years of altered water conditions. We are collecting trait data for two years of individuals from the different water treatments grown in a common garden and growing in the field after the end of the watering treatment. Our work will help restoration practitioners choose, based on the species or type of species, ecotypes with the best chance of success at a given site. For example, it will help practitioners predict when non-local seed will be able to swiftly adapt to a new area's water conditions vs. when locally adapted seed should be used. More broadly, our work will clarify how functional traits related to water availability vary within and between groups of short-lived grassland species. It will also help us better predict species ranges and survival in a changed climate.

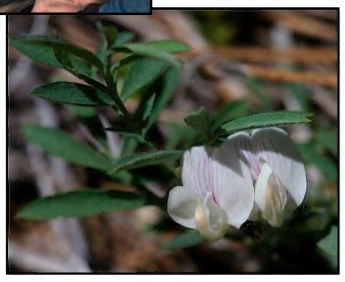
Kaylie De Luca is an MS student at the California State University, Chico.

The title of her research is "**Drakesbad Meadow sixteen years post restoration; a long-term study in Lassen Volcanic National Park (LVNP)."**

Meadow restoration projects commonly lack implementation of long-term monitoring of floristic change over time. Contrary to this trend, Drakesbad, a fen wet meadow complex located in LVNP has had pre- and post-restoration studies over the past twenty years be implemented. Collected information includes depth to water table (DTW), soils carbon, and vegetation composition, with specific attention on the abundance of *Carex simulata, C. utriculata, Scirpus microcarpus, Deschampsia cespitosa, Hordeum brachyantherum* and *Poa pratensis*. However, post-restoration analysis of the meadow's soil seedbank is lacking. Through this study, I will compare and contrast the 2002 seedbank, past vegetation and current vegetation with the current soil seedbank and draw connections between the plant species and the hydrology throughout the meadow. In early fall 2022 seedbank soils collected from 24 sites throughout the meadow were set up in Chico State's research greenhouse. Though much of the data will be analyzed fall 2022, documentation of the meadow's seedbank species will have to wait until spring 2023, when the plants have matured enough to be identified by use of the Jepson Manual. Status of the restoration and an overview of the resiliency and plant succession in Drakesbad Meadow will be compiled. This new and restructured information may be used by LVNP's land managers to create/update a response plan, to potentially resolve any future issues from unexpected perturbations that the fen wet meadow complex may experience.

2022-2023 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

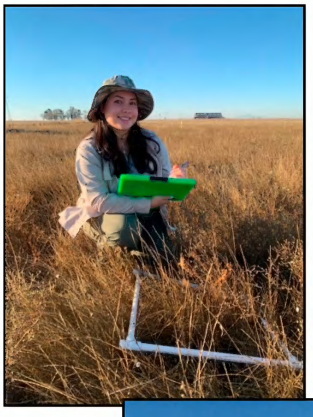
Ashley Dickinson is an MS student at California Polytechnic University, Humboldt.



The title of her research **is "Assessment of the genetic population structure and rate of clonality in a rare serpentine endemic *Lathyrus biflorus*, using ddRADseq."**

The two-flowered pea, *Lathyrus biflorus*, is a rare serpentine endemic found only within a single isolated population in remote Humboldt County, California. Inadequate information exists about the life history and population dynamics of the species which precludes informed predictions of population viability. Observations indicate that the two-flowered pea has limited sexual reproduction and that a large portion of the population may consist of physiologically distinct clones from rhizomatous growth. If true, then an effective population size cannot be determined based on above ground stem counts alone. While the effects of clonality on the survival of a rare species are complex, overwhelming evidence exists that a lack of genetic diversity puts a population at higher extinction risk due to evolutionary pressures and environmental stochasticity. Analysis of genomic data produced with Next Generation Sequencing technology can provide insights into genetic variation, evolutionary history, and rate of clonality within the population. My study aims to describe the genotypic and genetic diversity of *L. biflorus* and to determine the rate of clonality via double digest Restriction-site Associated DNA sequencing (ddRADseq). This research will provide critical demographic information necessary to assess the species' vulnerability to extinction and inform management decisions for conservation efforts.

Jasmine Rios is an MS student at the Sacramento State University.



The title of her research is **"Integrated Pest Management (IPM) Approaches to Control Invasive Plant Species in CA Vernal Pools."**

Integrated pest management (IPM) focuses on sustainable control methods to prevent the spread of invasive species. Many invasive plant species cause substantial environmental and economic impacts that threaten natural habitats. Using a combination of IPM approaches can target invasive plants at different phenological growth stages, while preventing resistance or tolerance of any single approach. Grazing, herbicide, and mowing are common approaches, each of which have their own caveats when used alone. One of the major weaknesses of grazing is that target weeds are only palatable to livestock during the early growth stages, and become unpalatable once the plant begins to mature. Repeated herbicide use can lead to herbicide resistant weeds, while mowing often needs repeated treatments to yield results, which can be time and labor intensive. These management approaches alone cannot effectively control invasive plants or sustain native plant communities. I will examine the efficacy of combining three IPM approaches to manage invasive plants within the grassland-vernal pool complex at the Yolo Bypass Wildlife Area. Treatment blocks will be randomly distributed within the grassland matrix and consist of 5 treatment plots, totaling 50 plots. Plots will consist of the control, grazing, grazing + herbicide, grazing + mowing, and grazing + herbicide + mowing. Success will be determined based on the reduction of invasive plant percent cover, and native cover increase. I expect to see additive effects of treatments with a decrease in invasive cover and an increase in native cover in plots using a single approach, and larger effects in plots with two or more combined approaches. These IPM approaches can be used to develop land management plans beyond vernal pool habitats, and provide solutions for environmental and economic impacts caused by invasive plant species in all landscapes.

2022-2023 Student Research Scholarship Awards (Cont.)

Kale McNeill is an MS student at California Polytechnic University, Humboldt

The title of their research **is "Systematics and population genetics of endangered wetland violets in Northern California."**

Species delimitation in *Viola* is challenging due to the diversity of the genus, its broad distribution, and its tendency to hybridize between clades and produce high polyploids. This project focuses on several threatened, disjunct populations of wetland violets, each in an at-risk ecosystem in which their distribution, habitat, and/or morphology call their current taxonomic identities into question. *Viola langsdorffii* is known from one sedge-dominated depression in the Tolowa Dunes of Del Norte County, regularly exhibits atypical petal count and arrangement, and appears strikingly different from the *V. langsdorffii* species complex found across the Bering Strait. *Viola palustris* has three extant Californian occurrences seen in the 21st century, which appear to belong to multiple lineages. *Viola primulifolia* ssp. *occidentalis,* a serpentine wetland endemic, is currently designated as a common East Coast species, although preliminary phylogenetic research places the western violet in a separate clade. As each population is currently assigned to widespread species, they are absent from state and federal endangered species lists and have limited protections. I will be combining phylogenomics, morphology, and karyology to resolve the identities of these violets, determine what hybridizations occurred in their evolutionary history, and measure genetic health of the populations to evaluate conservation priority. This study will result in a high-resolution phylogeny of all blue and white violets of California and the Pacific Northwest resulting in species placement for the populations of interest, and valuable data to aid in the conservation of native flora of the North Coast and understanding of speciation in the California Floristic Province.

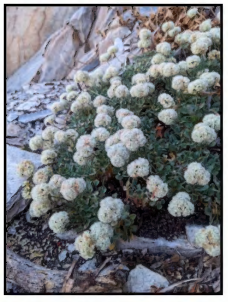
Brook Constantz is a PhD student at the University of California, Santa Cruz

The title of his research is **"Long-term Recovery of Restored Forest Overstory and Understories along the Sacramento River, California."**

Historically, riverine floodplains supported vast expanses of riparian vegetation extending kilometers from the active channel. By the late 1980s, only about five percent of the approximately 324,000 hectares of the Great Central Valley Riparian Forests remained. Restoration of these forests started in 1989 and has completed about half of the over 6,000-hectare goal. Previous research has studied these restored areas and the adjacent remnant forests to characterize the environmental factors influencing restoration. This research follows up on these studies to detail the recovery trajectory of different forest components over time. Spring surveys in 2021 and 2022 measured the composition of remnant and restored overstories and understories in 78 forest plots. Restored forest understories have much more abundant *Rubus armeniacus* (Himalayan blackberry) than remnant forests, which are characterized by more exotic graminoids and both native and exotic forbs. Restored and remnant forests, however, do not have a markedly different native shrub or native graminoid composition. Since prior overstory surveys, tree composition has broadened in restored forests to include both early and mid-successional species, while it has narrowed in remnant forests to include more late-successional species like *Juglans hindsii* (Northern California black walnut). Future research will strengthen the ecological signal of the understory study through a 2023 survey in another, hopefully wetter, water year.

2022-2023 STUDENT RESEARCH SCHOLARSHIP AWARDS (CONT.)

Courtney Matzke is an MS student at Claremont Graduate University.



The title of her research **is "A vascular floristic study of the Piute mountains (Kern County)."**

The proposed study will document the vascular flora of the Piute Mountain Range in Kern County, California. It forms the southern terminus of the Sierra Nevada and occurs near the intersections of the Central Valley, Tehachapi Mountains, and the Mojave Desert. This meeting-place of ecoregions and geologic substrates is predicted to host an exceptionally diverse flora. The Piute Mountain Range has several large gaps both geographically and temporally in the botanical collection record, leading to a high probability of locating new species occurrences, range extensions and species that are not currently described. Efforts will be made to document all populations of rare and endemic taxa, and the resulting data will be utilized in habitat protection and land management plans. The Piute Mountains are host to the southernmost populations of numerous taxa and obtaining a full picture of the present diversity in the area will be of particular importance when assessing the effects of climate change. In this project, plant vouchers will be collected along with GPS coordinates, elevation, associated species and habitat information. The data generated will be made publicly available in online databases as well as a manuscript publication. The outcome of this research will be a complete specimen-based inventory of the study area which will serve as invaluable data for numerous future studies.

Kaleb Goff is a PhD student at North Carolina State University.

The title of his research is **"Plant community responses to climate change over an 18-year period on alpine summits in the Sierra Nevada and Great Basin, USA."**

As species shift their distributions to track a rapidly changing climate, communities will reassemble. Mountain summits harbor a unique assemblage of plant species, which are generally long-lived, cold-adapted perennials, that may fail to track their climatic niches or adapt in situ. As mountain summits become warmer, species from lower elevations may colonize summits, increasing species richness at the peak scale. Alternatively, if dispersal and establishment rates from lower elevations are similar to extinction rates on summits, species richness could remain stable over time. GLORIA Great Basin, part of an international effort to monitor the effects of climate change on alpine plants, has been monitoring plant communities on 29 peaks (across 7 target regions) in the Sierra Nevada and Great Basin in the Western USA since 2004. In this study, we used the plant community data from the summits of all 29 of these peaks to examine how alpine species richness has changed over an 18-year period. Though individual summits varied in the direction and magnitude of change in species richness, species richness was relatively stable over time at the regional scale. We further examine species that were lost or gained on a given peak, within a given region, and across the study region. The results of this study will fill a critical data gap in the monitoring of alpine plant communities in semi-arid mountain ranges in the Western USA, which include critical water resources, biodiversity, and protected public lands.

2022-2023 Student Research Scholarship Awards (Cont.)

Kyle Rosenblad is a PhD student at University of California, Berkeley.

The title of his research is **"Climate change and evolutionary potential in a montane meadow-dependent species."**

Climate change poses special challenges to plant species that depend on isolated habitats like montane meadows. Their capacity to evolve adaptively in response to climate change may be limited by high genomic load of fitness-reducing alleles. Opportunities to migrate to new, more climatically favorable patches may also be limited because habitat patches are often separated by large swaths of unsuitable habitat. Inbound flow of new adaptive alleles may be limited for the same reason. Recent advances in genomics have allowed researchers to estimate the degree of local adaptation among conspecific populations, the frequency of successful movement among localities, and genomic load. These tools hold great potential and could be integrated with species distribution models, which predict broad-scale habitat associations, to produce comprehensive assessments of species' potential to respond to climate change. However, such integrative studies are scarce, and a knowledge gap remains regarding the climate-relevant evolutionary potential of taxa that depend on isolated habitat patches. To address this gap, I am using the recently developed FOLDS method of conservation genomics to examine Lemmon's willow (*Salix lemmonii*) populations across the southern Cascade, Sierra Nevada, and San Bernardino mountains to produce an integrated assessment of this species' climate-relevant evolutionary potential. Often the dominant woody vegetation, *S. lemmonii* depends on montane meadow habitat, where it is planted frequently in meadow restoration. *S. lemmonii* forms habitat for endangered wildlife like the Willow Flycatcher (*Empidonax traillii*), provides medicine and weaving materials to indigenous communities, and guards against streambank erosion and ecohydrological degradation, thereby protecting water resources for people downstream. The outputs of this research will help clarify how species depending on isolated habitats may respond to climate change, as well as informing potential management strategies for a socioeconomically important species in California.

Larke Reeber is an MS student at San Jose State University.

The title of her research is **"Species delimitation of a moss clade in a global hotspot for bryophyte diversity."**

Homalothecium is a wide-spread genus of moss with its center of diversity in northern California, a global hotspot for bryophyte diversity and endemism. Although most of the species within the genus are easily identified, the species *H. pinnatifidum* is more challenging to differentiate because its morphology is highly variable. As a result, there is disagreement among bryologists about its classification. There are three competing hypotheses: a) Individuals classified as *H. pinnatifidum* should actually be classified as *H. aureum*, a species found in the Mediterranean; b) *H. pinnatifidum* is a single species distinct from *H. aureum*; or c) *H. pinnatifidum* represents more than one species. My study will resolve this issue with a careful morphometric analysis and the construction of a DNA-based phylogeny using specimens that encompass the geographic and ecological breadth of the species. So far, a review of the leaf and sporophyte morphological characters from 200 herbarium and field collected specimens of *H. pinnatifidum* show they can be grouped into five distinct morphotypes. These preliminary results support the hypothesis that there are multiple undescribed species within *H. pinnatifidum*. My next steps will be to build a phylogeny of the genus with inclusion of the unique *H. pinnatifidum* morphotypes. This will allow me to test whether these morphological groupings are a reflection of great phenotypic plasticity within the species or reflect actual clades that need species descriptions.

NORTHERN CALIFORNIA
BOTANISTS

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If you haven't already, please renew your membership for 2023!

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